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Johnson et al.

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[54] **RAPID FIRE COMPRESSED AIR TOY GUN**

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[73] Assignee: **Johnson Research & Development Company, Inc.**, Smyrna, Ga.

[21] Appl. No.: **08/822,008**

[22] Filed: **Mar. 24, 1997**

Related U.S. Application Data

[63] Continuation-in-part of application No. 08/730,619, Oct. 21, 1996, Pat. No. 5,709,199, which is a continuation-in-part of application No. 08/699,431, Aug. 19, 1996, Pat. No. 5,699,781, which is a continuation-in-part of application No. 08/494,407, Jun. 26, 1995, Pat. No. 5,592,931, which is a continuation-in-part of application No. 08/441,229, May 15, 1995, Pat. No. 5,596,978.

[51] **Int. Cl.**[6] **F41B 11/00**

[52] **U.S. Cl.** **124/72**; 124/73; 124/75; 124/76

[58] **Field of Search** 124/72, 73, 75, 124/76, 69

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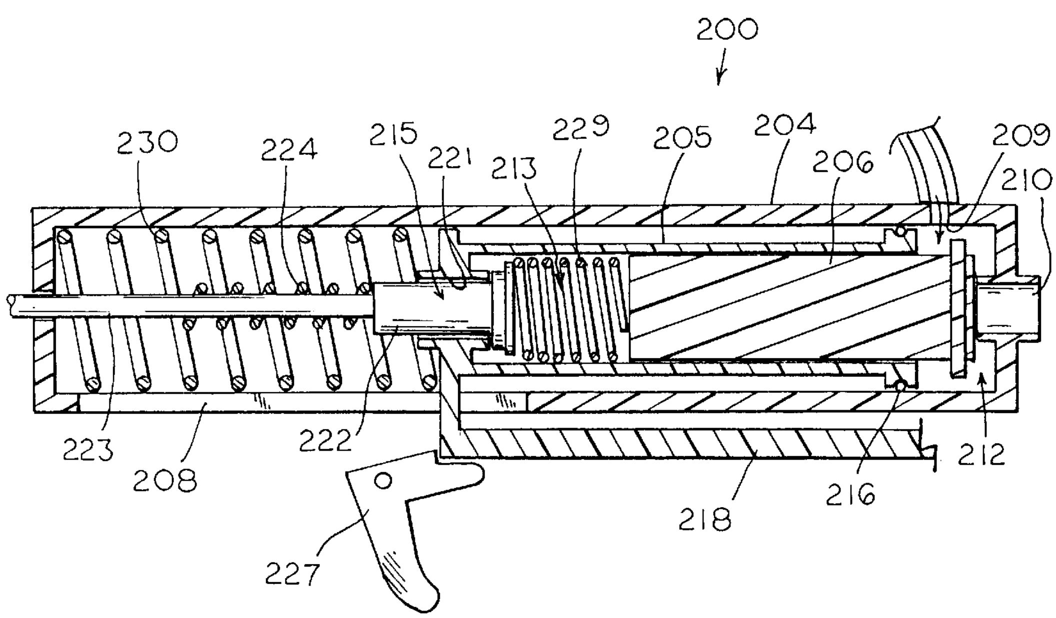
Attorney, Agent, or Firm—Kennedy, Davis & Kennedy, P.C.

[57] **ABSTRACT**

An air compressed gun (**10**) is provided having a stock (**11**), a barrel (**12**), a trigger (**13**) and a manual air pump (**14**). The gun also has a control valve (**200**) which controls the flow of compressed air into a magazine (**202**). The control valve includes an external tube (**204**), an internal tube (**205**) reciprocally mounted within the external tube, and a plunger (**206**) reciprocally mounted within the internal tube.

31 Claims, 12 Drawing Sheets



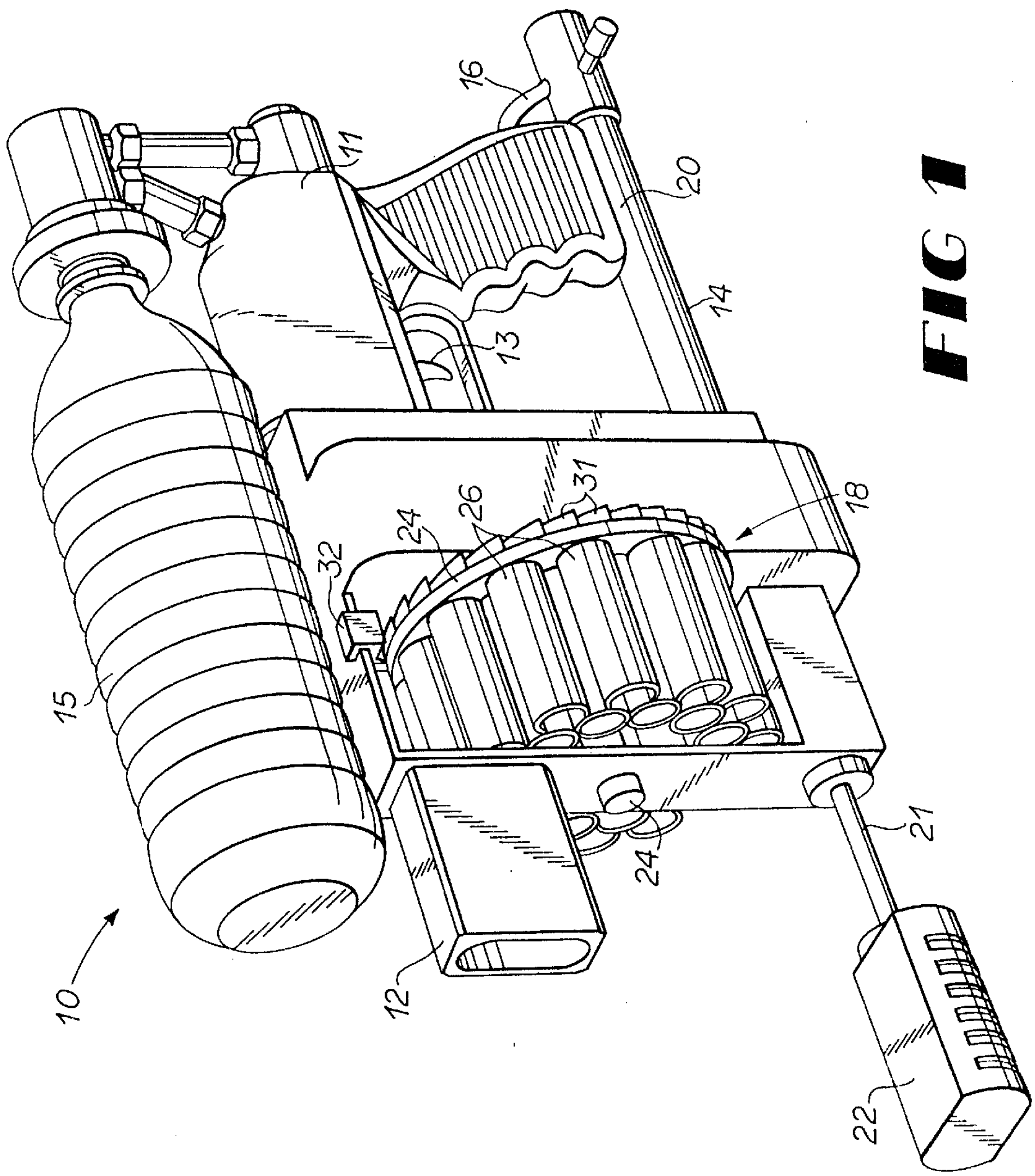


FIG 1

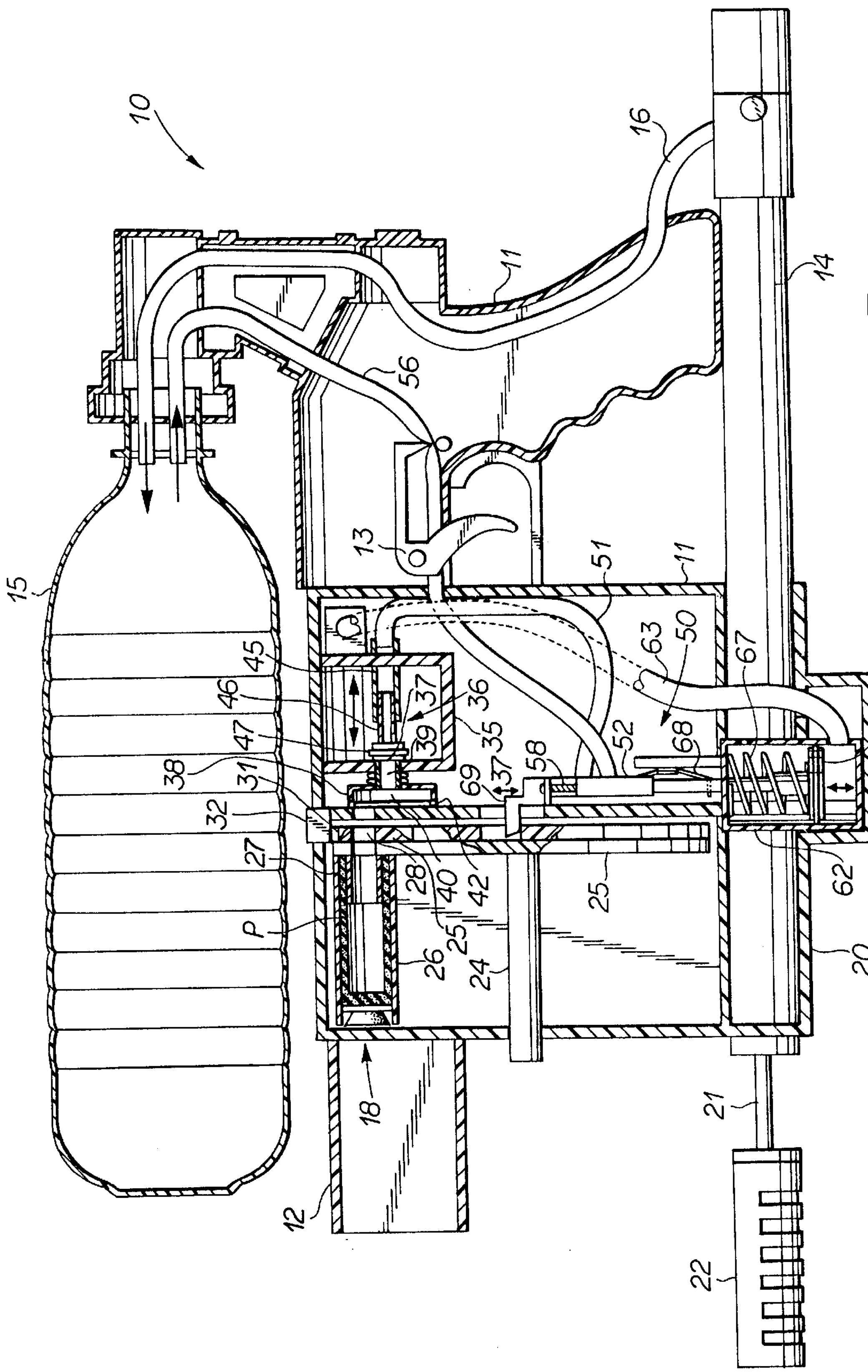

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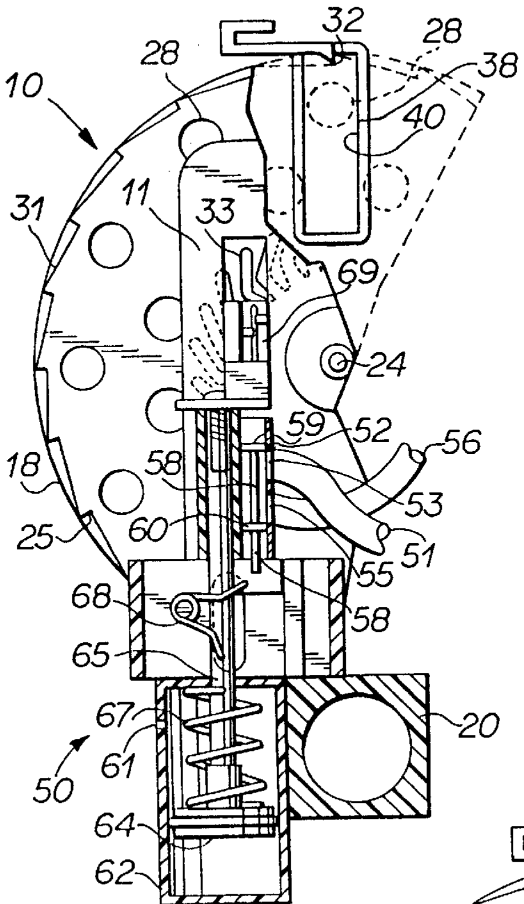
FIG 2



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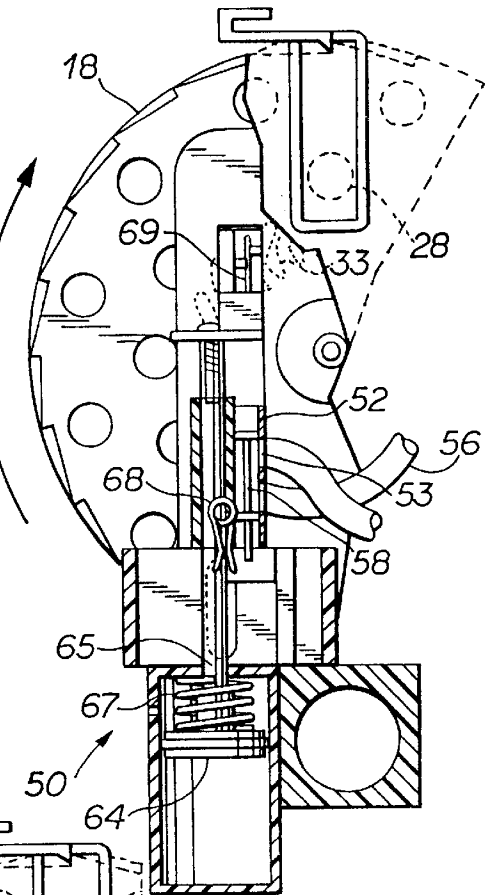

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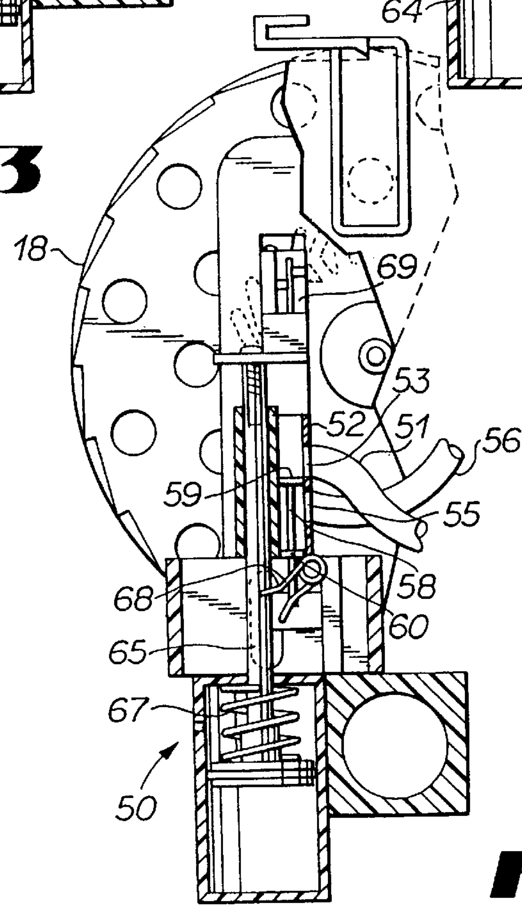

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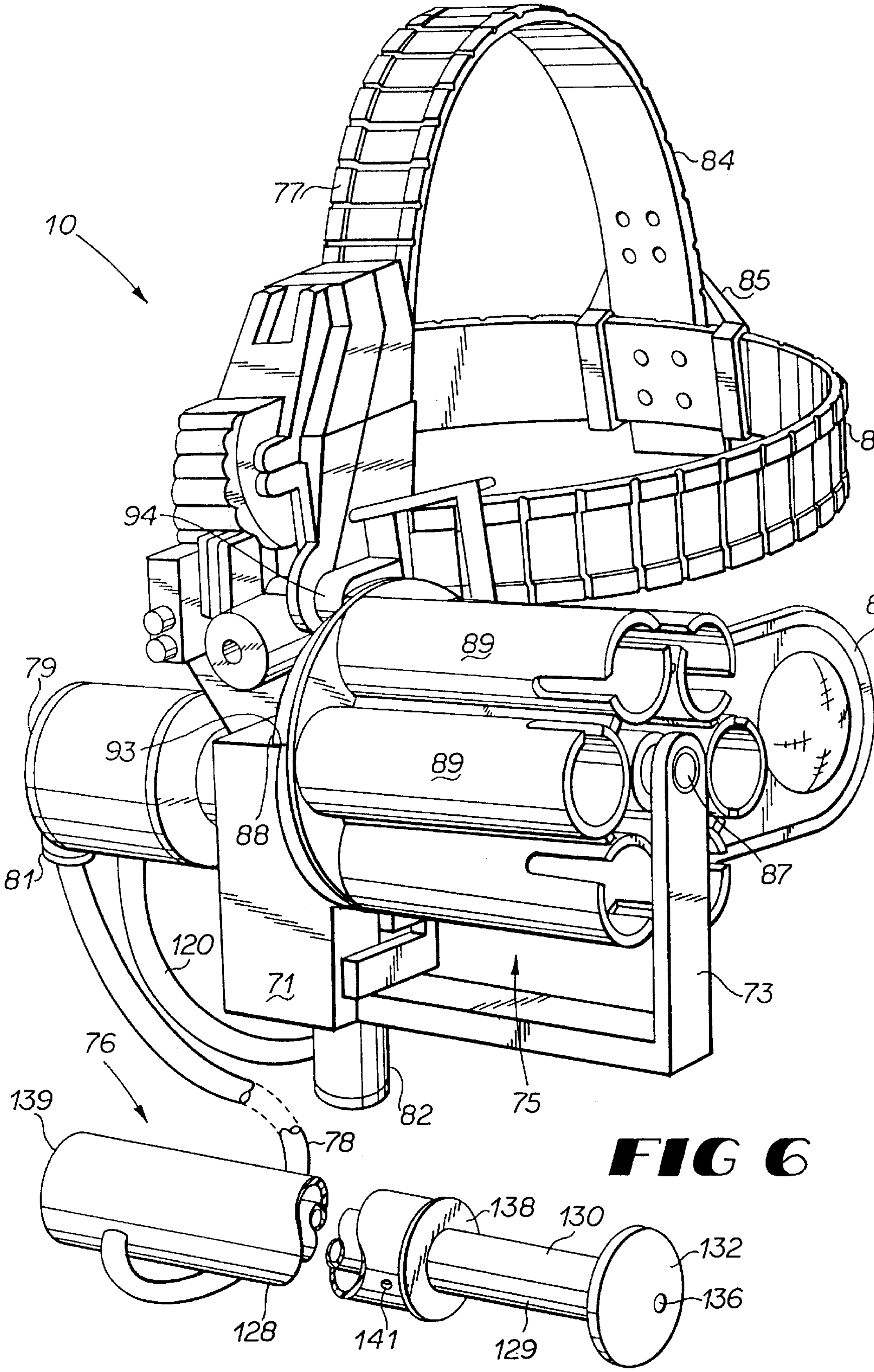
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FIG 6

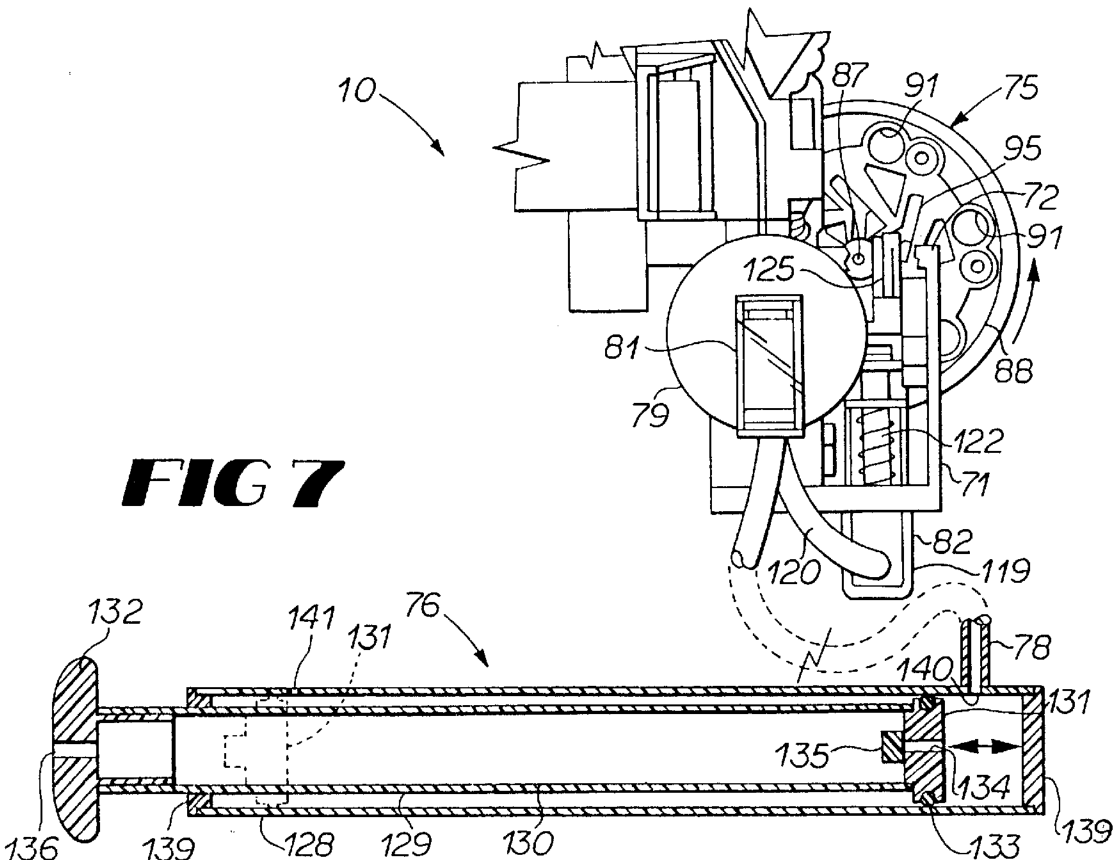
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FIG 7

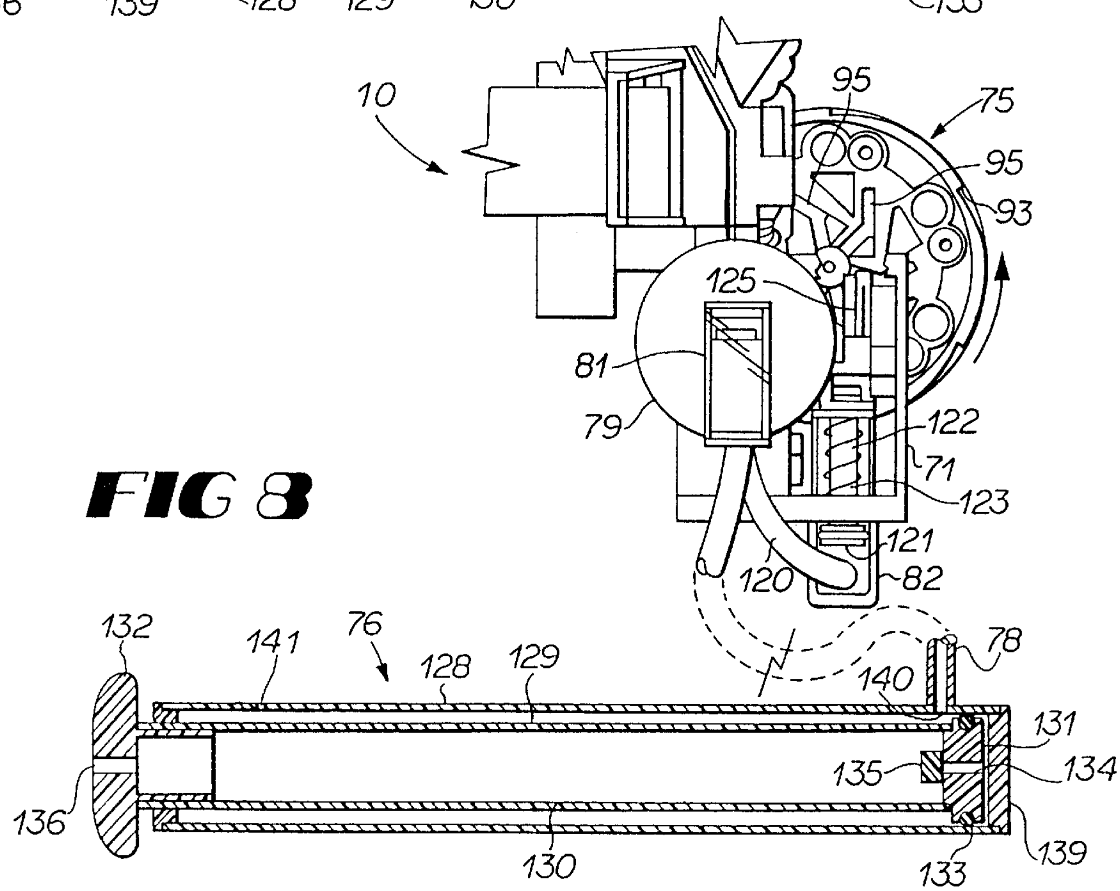
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FIG 8

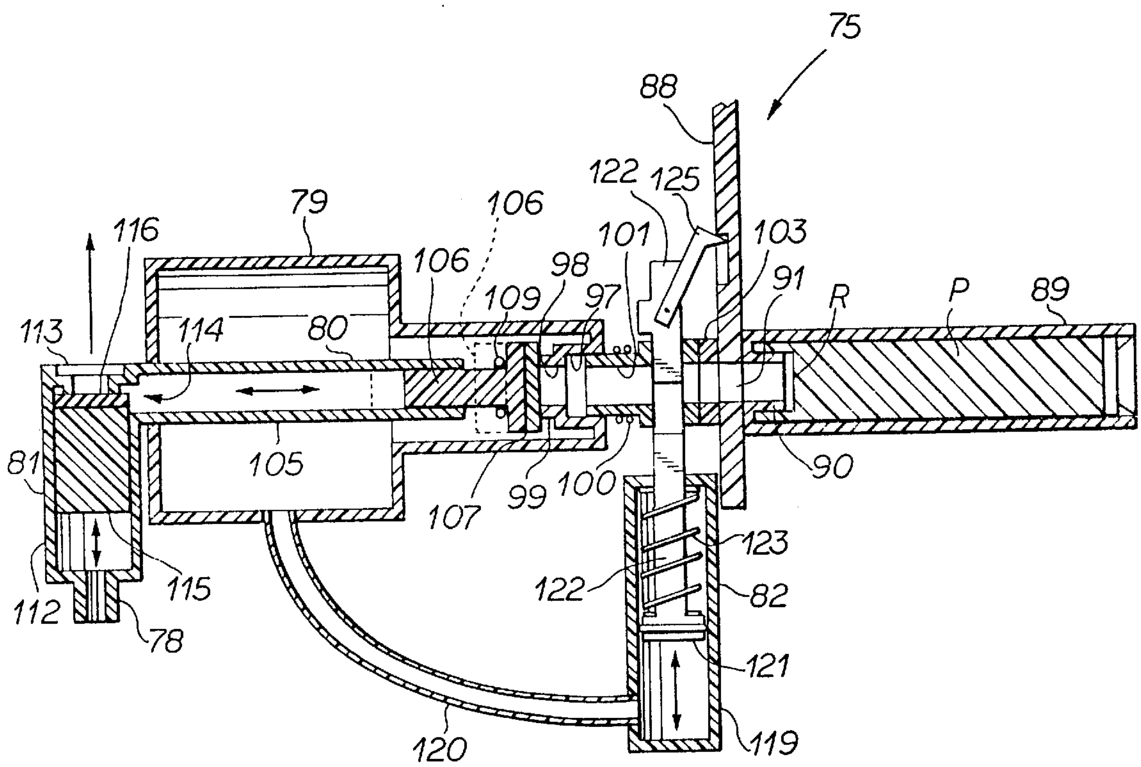
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FIG 9

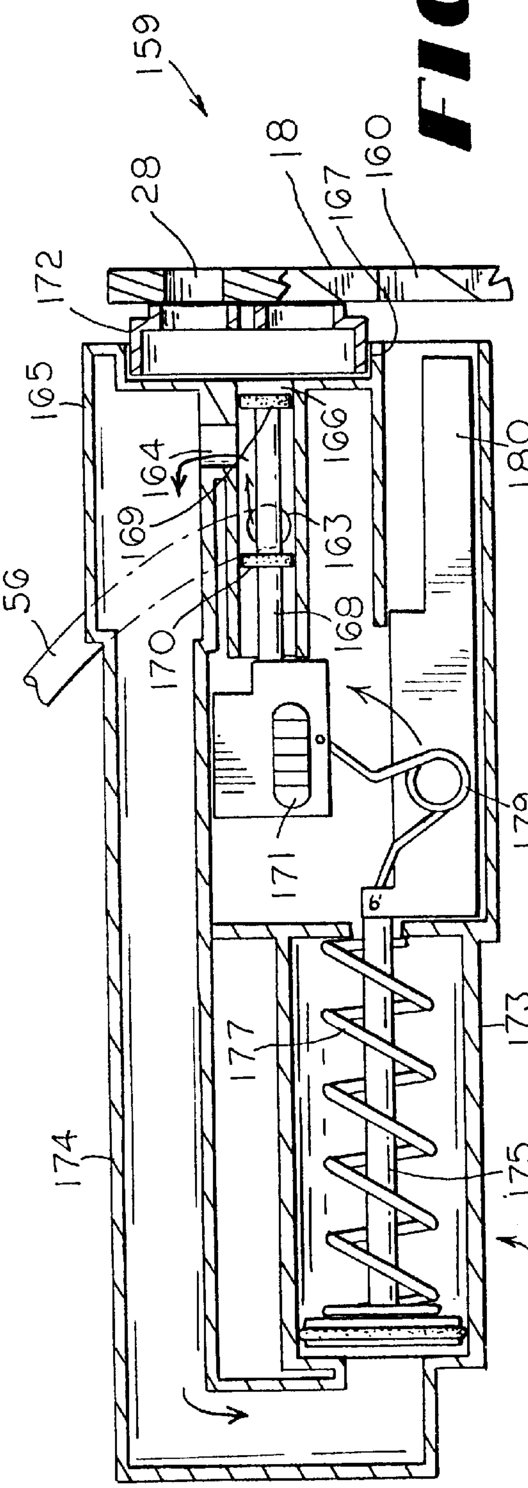
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FIG 10

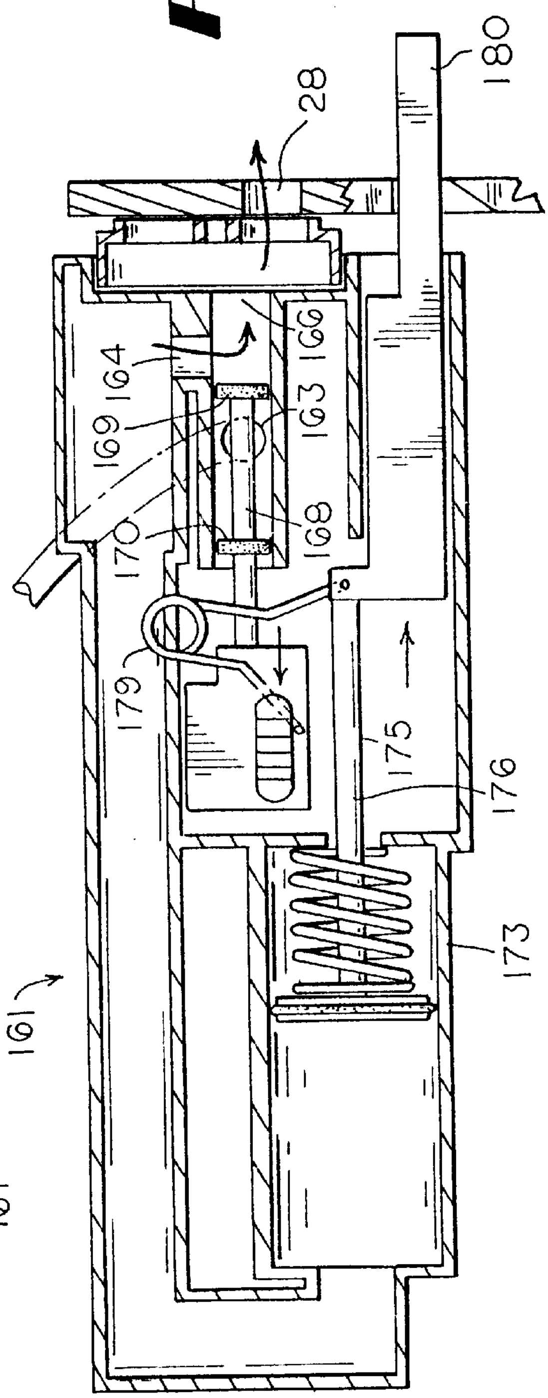
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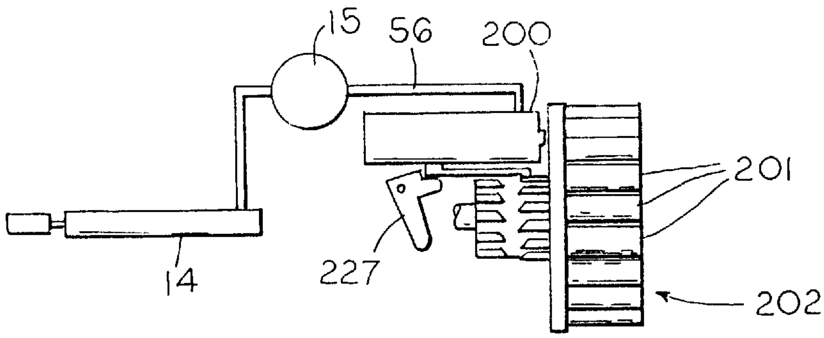
FIG 11



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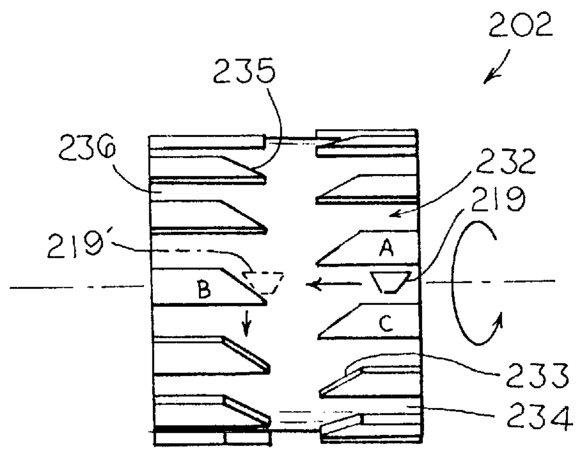

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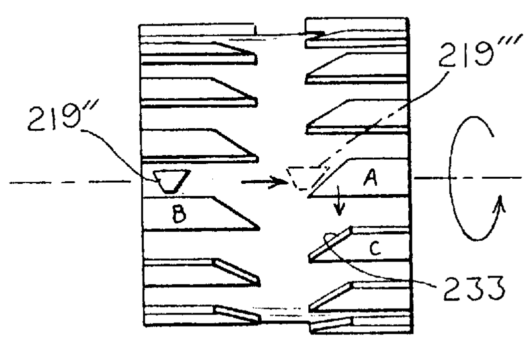
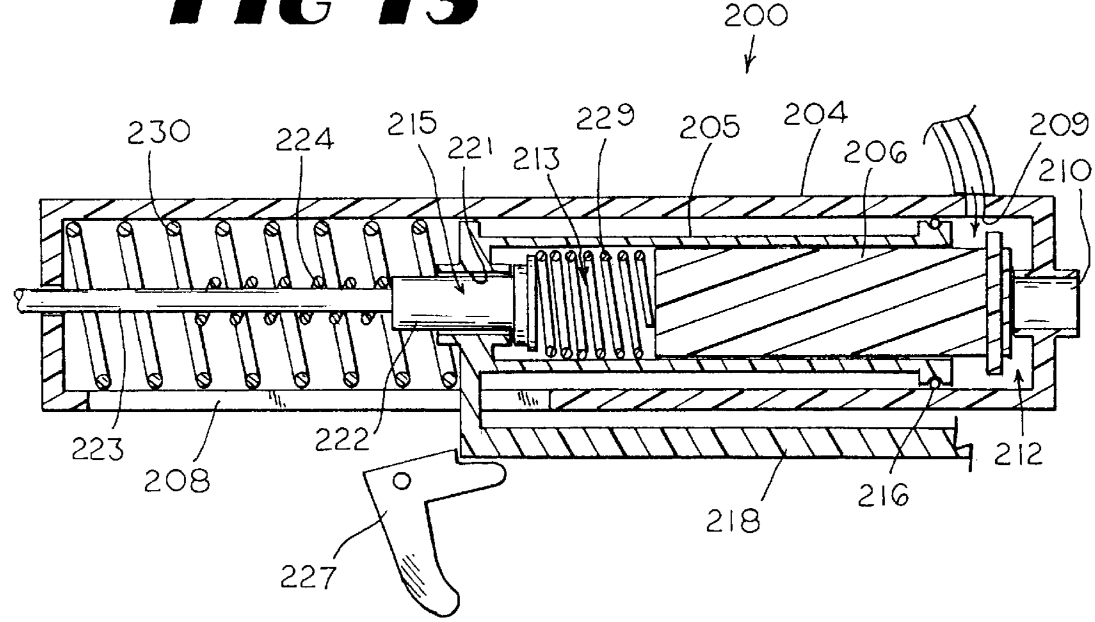


FIG 22

FIG 13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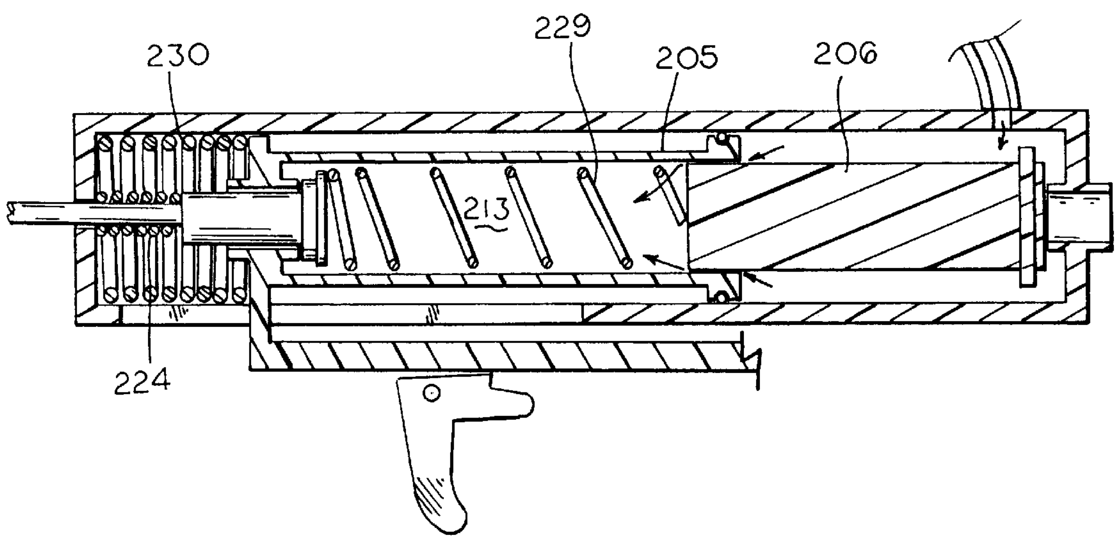
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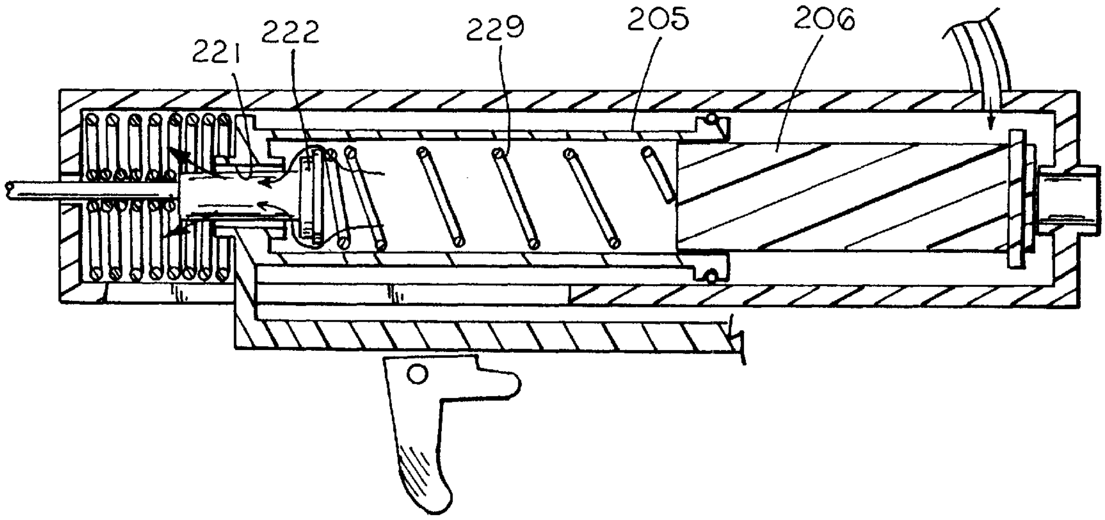
FIG 14

FIG 15



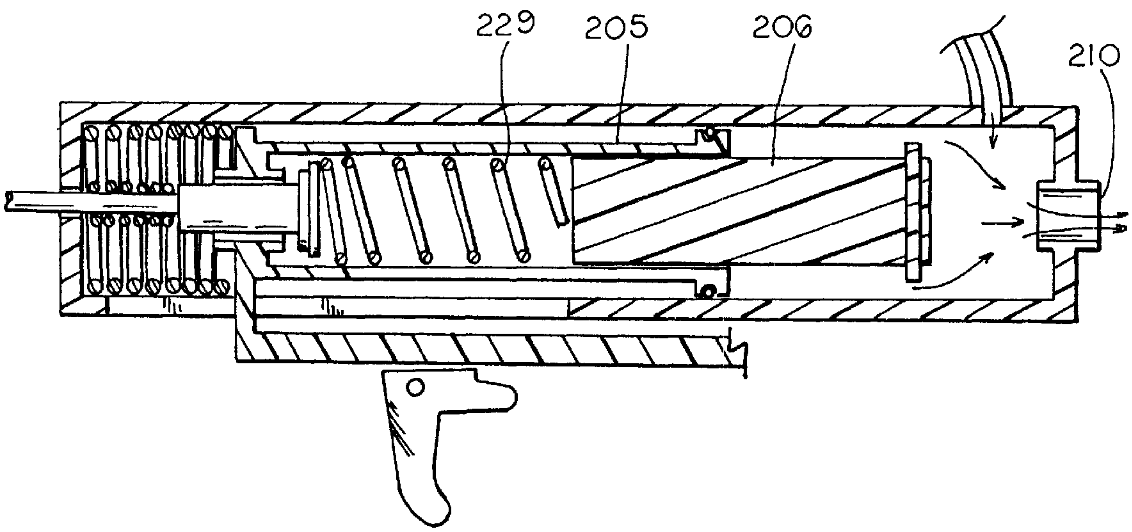
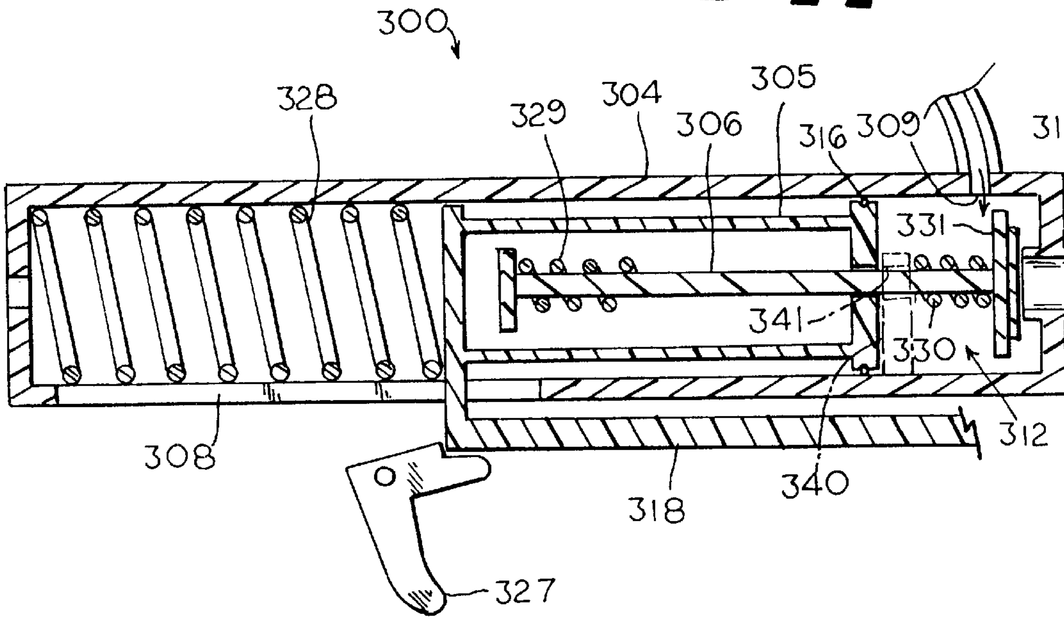


FIG 16

FIG 17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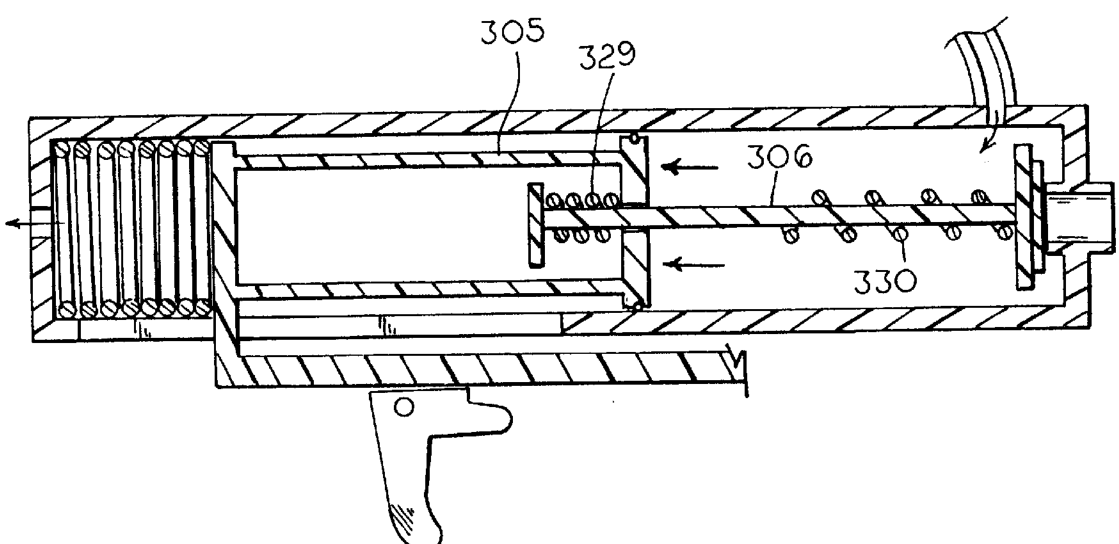
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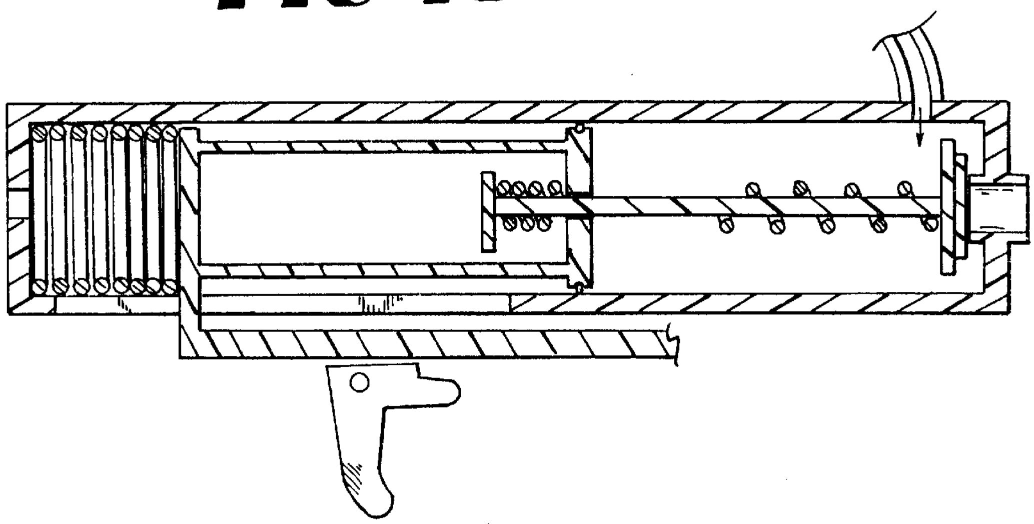
FIG 18

FIG 19



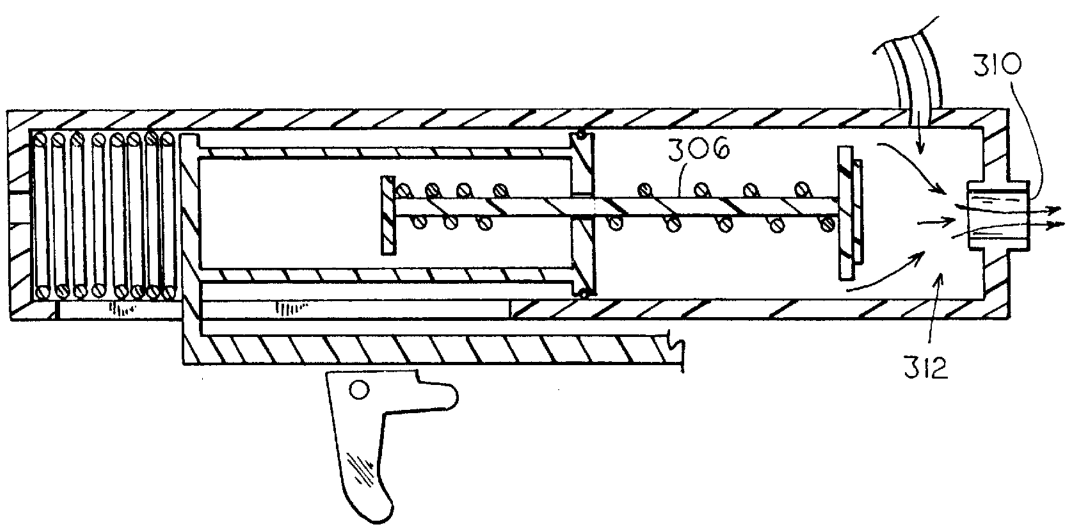


FIG 20

RAPID FIRE COMPRESSED AIR TOY GUN

REFERENCE TO RELATED APPLICATION

This is a continuation-in-part of application Ser. No. 08/730,619 filed Oct. 21, 1996 now U.S. Pat. No. 5,709,199, which is a continuation-in-part of application Ser. No. 08/699,431 filed Aug. 19, 1996 now U.S. Pat. No. 5,699,781, which is a continuation-in-part of application Ser. No. 08/494,407 filed Jun. 26, 1995 now U.S. Pat. No. 5,592,931, which is a continuation-in-part of application Ser. No. 08/441,229 filed May 15, 1995 now U.S. Pat. No. 5,596,978.

TECHNICAL FIELD

This invention relates to compressed air guns, and specifically to compressed air toy guns which include a magazine for holding projectiles and an indexer for indexing the magazine.

BACKGROUND OF THE INVENTION

Toy guns which shoot or launch projectiles have been very popular for many years. These guns have been designed to launch projectiles in a number of ways. A common method of launching has been by the compression of a spring which propels the projectile upon its decompression or release, as, for example, with BB guns and dart guns. These guns however usually do not generate enough force to launch projectiles with great velocity.

Toy guns have also been designed which use compressed air to launch projectiles such as foam darts. These types of guns use a reciprocating air pump to pressurize air within a pressure tank. In use, a single dart is loaded and the pump is typically reciprocated several times with each firing of the gun. Therefore, the gun must be loaded and pumped with each firing as it is not capable of firing several darts in rapid sequence. The rapid firing of a gun may be desired for those playing a mock war or other type of competition.

As children often become bored with the design of conventional guns it is desirous to design guns having an unconventional construction or appearance. However, unconventional guns are often difficult to accurately aim and fire.

Today children who play mock wars often carry several guns at one time in order to fire several shots simultaneously or in rapid succession. This however is difficult as two hands must be used to fire two separate guns and two hands are typically used to pump one gun. Hence, a child must choose to either fire a gun in each hand or pump one gun for firing.

Accordingly, it is seen that a need remains for a toy air gun which may be fired without restricting an operator's hands. Also, it is seen that a need remains for a toy air gun of an unconventional design which may be accurately aimed and fired. It is to the provision of such therefore that the present invention is primarily directed.

SUMMARY OF THE INVENTION

In a preferred form of the invention a compressed air toy gun for firing projectiles comprises pump means for compressing air, launch tube means for holding a projectile, conduit means for conveying compressed air from the pump means to the launch tube means, and control valve means for controlling the flow of compressed air from the pump means to the launch tube means. The control valve means has an external housing having an air inlet in fluid communication with the conduit means and an air outlet in fluid communication with the launch tube means. The control valve means also has an internal housing and a plunger. The internal housing is mounted for reciprocal movement within the external housing between a first position and a second position. Internal housing biasing means biases the internal housing towards the first position. The plunger is mounted within the internal housing for reciprocal movement between a sealing position sealing the air outlet and an unsealing position unsealing the air outlet. Plunger biasing means biases the plunger toward the sealing position. Actuation means actuates the movement of the plunger to the unsealing position. The external housing and the internal housing at least partially defining an air pressure chamber in fluid communication with the air inlet.

With this construction compressed air from the pump means is conveyed through the conduit means and through the air inlet into the air pressure chamber. The compressed air within the air pressure chamber biases the internal housing to its second position whereupon the actuation means causes the movement of the plunger is moved to its unsealing position allowing the compressed air within the air pressure chamber to flow through the air outlet to the launch tube.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a rapid fire compressed air gun embodying principles of the present invention in a preferred form.

FIG. **2** is a side view, shown in partial cross-section, of the air gun of FIG. **1**.

FIGS. **3–5** are a sequence of views showing a portion of the air gun of FIG. **1**, which show in sequence, the actuation of an actuator which indexes a magazine and controls a release valve.

FIG. **6** is a perspective view of a rapid fire compressed air gun embodying principles of the present invention in another preferred form.

FIG. **7** is a rear view of portions of the air gun of FIG. **6** with the pump shown in side view for clarity of explanation.

FIG. **8** is a rear view of portions of the air gun of FIG. **6** with the pump shown in side view for clarity of explanation.

FIG. **9** is a side view, shown in partial cross-section, of interior components of the air gun of FIG. **6** and a projectile positioned within the barrel of the gun.

FIG. **10** is a side view, shown in partial cross-section, of an alternative design for the interior components of the air gun of FIG. **1**, shown in a pressurizing configuration.

FIG. **11** is a side view, shown in partial cross-section, of the interior components shown in FIG. **10**, shown in a firing configuration.

FIG. **12** is a schematic view of portions of an air compressed gun in another preferred form.

FIGS. **13–16** are a sequence of side views, shown in partial cross-section, of a portion of the interior components of the air gun of FIG. **12**, which show in sequence, the actuation of the interior components controlling the release of pressurized air.

FIGS. **17–20** are a sequence of side views, shown in partial cross-section, of a portion of the interior components in another preferred embodiment, which show in sequence, the actuation of the interior components controlling the release of pressurized air.

FIGS. **21** and **22** are a sequence of top views of the magazine of the air gun of FIG. **12**, which show in sequence, the rotation of the magazine in conjunction with the actuation of the control valve.

DETAILED DESCRIPTION

With reference next to the drawings, there is shown a compressed air gun **10** having a stock or handle **11**, a barrel **12** mounted to the stock **11**, a spring biased trigger **13**, and a manual air pump **14**. The gun **10** has a pressure chamber or tank **15** in fluid communication with the air pump **14** through a pressure tube **16** and a multi-projectile magazine **18** rotationally mounted to stock **11**. The pump **14** includes a conventional cylinder **20**, a cylinder rod **21** and a handle **22** mounted to an end of the cylinder rod **21**.

The magazine **18** has a central pivot rod **24** mounted to a diskshaped mounting plate **25** and an annular array of projectile barrels **26** extending from the mounting plate **25** in generally two concentric circles about pivot rod **24**. Each barrel **26** has a launch tube **27** therein aligned with an opening **28** extending through the mounting plate **25**. Likewise, the openings **29** are oriented in two concentric circles or annular arrays with each opening of the inner circle being positioned generally between two adjacent opening of the outer circle, so as to appear in staggered fashion, as best shown in FIGS. **3**–**5**. Thus, each opening **28'** of the outer annular array of openings **28'** is aligned along a radius and spaced a selected distance d**1** from the center of the mounting plate, and each opening **28"** of the inner annular array of openings **28"** is aligned along a radius and spaced a selected distance d**2** from the center. The gun magazine is shown in FIG. **2** as having only one barrel for clarity of explanation. Mounting plate **25** has series of peripheral, outwardly extending, serrated teeth **31** each of which is aligned with a barrel **26**. The serrated teeth **31** are configured to cooperate with a pawl **32** extending from the stock **11**. The mounting plate **25** also has an annular array of L-shaped grooves **33** equal in number to the number of magazine barrels **26**.

The gun **10** has a pressure chamber **35** adapted to receive and store a supply of air at elevated pressure levels and a pressure sensitive release valve **36** mounted within the pressure chamber **35**. The pressure chamber **35** has an exit opening **37** therein. A spring biased sealing plate **38** is mounted within opening **37**. The sealing plate **38** has a central bore **39** extending into an elongated bore **40** configured to overlay the mounting plate openings **28**. It should be noted that the mounting plate openings **28** are positioned so that the sealing plate elongated bore **40** overlaps only one opening **28** at a time. A gasket **42** is mounted to the sealing plate **38** to ensure sealing engagement of the sealing plate with the mounting plate **25**. The release valve **36** has a cylindrical manifold **45** and a cylindrical plunger **46** slidably mounted within manifold **45**. Plunger **46** has a gasket **47** to ensure sealing engagement of the plunger about opening **37**.

The release valve manifold **45** is pneumatically coupled to an actuator **50**, by a pressure tube **51** extending therebetween the actuator **50** automatically and sequentially causes the actuation of the release valve **36**. Actuator **50** includes an elongated manifold **52** having an upper opening **53** in fluid communication with pressure tube **51** and a lower opening **55** in fluid communication with another pressure tube **56** extending from the pressure tank **15** and positioned so as to be pinchably closed by spring biased trigger **13**. A piston **58** is movably mounted within actuator manifold **52**. Piston **58** has a top seal **59** and a bottom seal **60**. The actuator **50** also has a pressure cylinder **62** having a vent **61** adjacent its top end. Pressure cylinder **62** is coupled in fluid communication with pressure chamber **35** by a pressure tube **63**. A piston **64**, having an elongated piston rod **65**, is mounted within the actuator pressure cylinder **62** for reciprocal movement therein between a low pressure position shown in FIGS. **2** and **3** and a high pressure position shown in FIG. **4**. A coil spring **67** mounted about piston rod **65** biases the piston **64** towards its low pressure position. Piston rod **65** is coupled to piston **58** by an over center torsion spring **68**, such as that made by Barnes Group Incorporated of Corry, Pennsylvania under model number T038180218-R. An indexing finger **69**, mounted to an end of the piston rod **65**, is configured to sequentially engage and ride within each magazine L-shaped groove **33**.

In use, an operator actuates the pump to pressurize a supply of air by grasping the handle **22** and reciprocating the cylinder rod **21** back and forth within the cylinder **20**. Pressurized air is passed through pressure tube **16** into the pressure tank **15**. Manual actuation of the trigger **13** moves the trigger to a position wherein it unpinches pressure tube **56** so as to allow pressurized air within the pressure tank **15** to pass through pressure tube **56** into actuator manifold **52** between the top and bottom seals **59** and **60**. The pressurized air then passes out of lower opening **55** and through pressure tube **51** into release valve manifold **45**.

The pressurized air within the release valve manifold **45** causes the plunger **46** to move to a forward position sealing the opening **37**. Pressurized air then flows between the plunger **46** and the release valve manifold **45** so as to pressurize the pressure chamber **35**. A portion of the pressurized air within pressure chamber **35** passes through pressure tube **63** into the actuator pressure cylinder **62**. With increased pressure within pressure cylinder **62** the piston **64** is forced upwards against the biasing force of coil spring **67**, i.e. the piston **64** is moved from its low pressure position shown in FIG. **3** to its high pressure position shown in FIG. **4**. As shown in FIG. **4**, upward movement of the piston rod **65** causes compression of torsion spring **68** and the finger **69** to ride up within a mounting plate groove **33** thereby causing clockwise rotation of the magazine **18** which brings opening **28"** into fluid communication with seal plate **38**. All references herein to downward and upward directions is for purposes of clarity in reference to the drawings and is not meant to indicate gravity sensitivity. Upon reaching the apex of the movement of piston rod **65** the torsion spring **68** decompresses thereby forcing piston **58** downward, as shown in FIG. **5**. Downward movement of piston **58** causes the top seal **59** to be positioned between upper opening **53** and lower opening **55**. This positioning of the piston **58** isolates manifold lower opening **55** to prevent escape of pressurized air from pressure tank **15**. This positioning of the top seal **59** also allows pressurized air within pressure tube **51** to escape to ambience through the top of actuator manifold **52**. The release of air pressure causes the plunger **46** to move to a rearward position unsealing opening **37**. With the unsealing of opening **37** pressurized air within pressure chamber **35** flows through opening **37**, into the central and elongated bores **39** and **40** of sealing plate **38**, and into the launch tube **27** through mounting plate opening **28**. Pressurized air within launch tube **27** propels the projectile out of the magazine barrel **26** and through gun barrel **12**. The actuation of this type of release valve is described in more detail in U.S. Pat. No. 4,159,705.

Upon the release of pressurized air from pressure chamber **35** the pressurized air within pressure cylinder **62** is released through pressure tube **63** back into pressure chamber **35**. The release of air from pressure cylinder **62** causes the piston **64** be spring biased by coil spring **67** back downward to its low pressure position. The downward movement of piston **64** retracts the indexing finger **69** from within a mounting plate groove **33** and positions the finger in register with the following mounting plate groove **33**. The low pressure positioning of piston **64** causes the torsion spring **68** to bias piston **58** upwards to its initial position with the top and bottom seals **59** and **60** straddling upper and lower openings **53** and **55**, as shown in FIG. **3**. This repositioning of piston **58** once again causes pressurized air within pressure tank **15** to flow through pressure tube **56** into actuator manifold **52**, thereby completing a firing cycle. The firing and indexing cycle just describe may continue in rapid sequence so long as the trigger is maintained in a position allowing the flow of pressurized air through pressure tube **56** and the pressure tank continues to contains a minimal level of pressurized air sufficient to overcome the biasing force of springs **67** and **68**, i.e. the release valve is automatically actuated by actuator **50** and the indexing of magazine **18** continues so long as the trigger is pulled open and the pressure tank contains pressurized air above a level to overcome springs **67** and **68**. Should the pressure level within pressure tank **15** reach the minimal level the operator simply actuates the manual air pump **14** so as to once again elevate the pressure within the pressure tank.

As described, the gun may be used in a fully automatic manner such that with the trigger maintained in a pulled back, actuated position the gun fires a series of projectiles without stopping between each successive shot, similar to the action of a machine gun. However, should an operator wish to fire a single projectile, one need only to pull the trigger and quickly release it so that pressurized air does not continue to flow into the actuator **50**. Operated in such a manner the gun will index the magazine and fire a projectile with each actuation of the trigger, again, so long as the pressure tank contains air pressurized above the minimal level and the trigger is quickly released.

It should be noted that pawl **32** engages teeth **31** to prevent rotation of the magazine in a direction opposite to its indexing direction, i.e. to prevent counterclockwise rotation in FIG. **3**. This prevents the firing of pressurized air into a just emptied barrel and damage to the indexing finger. It should also be noted that since the pneumatic system is closed, once the gun is initially pressurized it is maintained under at least the minimal pressure level. Thus, the gun has the capability of firing projectiles in a rapid sequence of shots one after another. Yet, the gun may also fire a sequence of single shots without having to be pumped between each successive shot.

Referring next to FIGS. **6–9**, a compressed air gun **70** in another preferred form is shown. Here, the air gun **70** has a housing **71** having a support plate **72** and an L-shaped support arm **73**, a magazine **75** rotationally mounted to the housing **71**, a remote manual hand air pump **76**, and a harness **77** secured to housing **71** and configured to be supported upon the head of a person. The gun **70** has a pressure chamber **79** adapted to receive and store a supply of air at elevated pressure levels and a pressure actuatable release valve **80** mounted within the pressure chamber **79**. A control valve **81** is mounted in fluid communication with release valve **80** and is coupled in fluid communication with pump **76** by a pressure tube **78** extending therebetween. Pressure chamber **79** is pneumatically coupled to a pneumatic indexer **82** which in turn is coupled to magazine **75** for rotational movement thereof.

The head harness **77** has a generally circular base strap **83** and a inverted U-shaped, adjustable top strap **84** secured to the base strap **83** by a buckle **85**. The head harness **77** also has a clear eye sight **86** configured to be positioned over the eye of a person. The top strap **84** and base strap **83** may be made of a soft, flexible plastic which can conform to the person's head.

The magazine **75** has a central pivot rod **87** fixedly mounted to a disk-shaped mounting plate **88** and an annular array of projectile barrels or launch tubes **89** extending from the mounting plate **88** in a generally concentric circle about pivot rod **87**. Pivot rod **87** is rotationally mounted at one end to support arm **73** and rotationally mounted at its opposite end to support plate **72**. Each barrel **89** has a launch tube **90** therein aligned with an opening **91** which extends through the mounting plate **88**. The interior diameter of barrel **89** is configured to releasably hold a projectile P with the launch tube **90** configured to be received within a recess R in the rear of the projectile. The magazine is shown in FIG. **9** as having only one barrel **89** for clarity of explanation.. Mounting plate **88** has series of peripheral notches **93** each of which is aligned with a barrel **89**. The notches **93** are configured to cooperate with a pawl **94** extending from the housing **71**. Mounting plate **88** also has an annular array of L-shaped grooves **95** oriented about pivot rod **87** which are equal in number to the number of magazine barrels **89**.

The pressure chamber **79** has a recess **97** having an air exit opening **98** therein defined by an inwardly extending annular flange **99**. A spring biased sealing plate **100** is mounted within recess **97**. The sealing plate **100** has a central bore **101** configured to overlay the mounting plate openings **91** of the magazine. It should be noted that the mounting plate openings **91** are positioned so that the sealing plate bore **101** overlaps only one opening **91** at a time. A gasket **103** is mounted to the sealing plate **100** to ensure sealing engagement with the mounting plate **88**. The release valve **80** has a cylindrical manifold **105** and a cylindrical plunger **106** slidably mounted within the manifold **105**. Plunger **106** has a gasket **107** to ensure sealing engagement of the plunger **106** about opening **98** with the plunger in a sealing position shown in FIG. **9**, and a O-ring type seal **109** to ensure sealing engagement of the plunger **106** against manifold flange **99** with the plunger in a released position shown in phantom lines in FIG. **9**.

The control valve **81** has an elongated cylindrical manifold **112** having a top vent opening **113** to ambience, a side opening **114** in fluid communication with release valve manifold **105**, and a cylindrical plunger **115** slidably mounted within manifold **112**. Plunger **115** has a gasket **116** to ensure sealing engagement of the plunger about vent opening **113** with the plunger in a pressurized position shown in FIGS. **7** and **9**.

The indexer **82** has a pressure cylinder **119** coupled in fluid communication with pressure chamber **79** by a pressure tube **120**. A piston **121**, having an elongated piston rod **122**, is mounted within the indexer pressure cylinder **119** for reciprocal movement therein between a low pressure position shown in FIG. **8** and a high pressure position shown in FIGS. **7** and **9**. A coil spring **123** is mounted about piston rod **122** so as to bias the piston **121** towards its low pressure position. A spring biased indexing finger **125** is pivotably mounted to piston rod **125**. Indexing finger **125** is configured to sequentially engage and ride within each magazine groove **95** as the piston rod is moved upward and to disengage the groove as the piston rod is moved downward. All references herein to downward and upward directions is for purposes of clarity in reference to the drawings and is not meant to indicate gravity sensitivity.

The air pump **76** includes an elongated cylinder **128** and a plunger **129** telescopically mounted for reciprocal movement within the cylinder **128**. Plunger **129** has a tubular shaft **130** with an enlarged sealing end **131** and a handle **132** opposite the sealing end **131**. Sealing end **131** has an O-ring type seal **133** with an opening **134** therethrough, and a conventional check valve **135** mounted within opening **134**. Check valve **135** is oriented to allow air to pass from the interior of cylinder **128** through opening **134** into the interior of shaft **130** and to prevent air from passing through opening **134** in the opposite direction. Handle **132** has a vent **136** therethrough which allows air to pass from ambience into the interior of shaft **130**.

Pump cylinder **128** has an open end **138** through which plunger **129** extends and a closed end **139**. The pump cylinder **128** also has a port **140** in fluid communication with pressure tube **78** and a vent **141** adjacent open end **138** which is open to ambience. Port **140** is spaced from closed end **139** so as to allow seal **133** of plunger **129** to be moved past the port **140** to a position closely adjacent to the closed end **139**, as shown in FIG. **8**.

In use, a person dons the gun by securing the head harness **77** to his head with the magazine **75** to one side. The person then actuates the pump **76** by grasping the pump handle **132** and forcing the pump plunger **129** through cylinder **128** towards port **140** thereby pressurizing air within the cylinder. Thus, the plunger **129** is moved from a first position shown in phantom lines in FIG. **7** to generally a second position shown in FIG. **7**. The pressurized air passes through port **140** into pressure tube **78** where it then passes through control valve **81**. The increase in air pressure within the control valve manifold **112** forces the control valve plunger **115** to move to an upper, pressurized position sealing vent opening **113**, as shown in FIG. **9**. The pressurized air then passes about plunger **115** and through side opening **114** into the release valve manifold **105**. The increase in air pressure within the release valve manifold **105** forces the control valve plunger **106** to move to a forward, pressurized position sealing opening **98**, as shown in FIG. **9**. The pressurized air then flows between the release valve plunger **106** and the release valve manifold **105** into pressure chamber **79**.

A portion of the pressurized air within pressure chamber **79** passes through pressure tube **120** into the indexer pressure cylinder **119**. With increased pressure within pressure cylinder **119** the indexer piston **121** is forced upwards against the biasing force of coil spring **123**, i.e. the indexer piston **121** is moved from its low pressure position shown in FIG. **8** to its high pressure position shown in FIGS. **7** and **9**. As shown in FIG. **9**, upward movement of the piston rod **122** causes the finger **125** to ride up within a mounting plate groove **95** to cause counter-clockwise rotation of the magazine **75** as indicated by arrows in FIGS. **7** and **8**.

With continued movement of the pump plunger **129** within pump cylinder **128** the seal **133** passes pump cylinder port **140**, as shown in FIG. **8**. With the plunger seal **133** in this position pressurized air within pressure tube **78** is released back into pump cylinder **128** behind seal **133** and then to ambience through vent **141**. The reentry of pressurized air into the pump cylinder **128** from pressure tube **78** causes the control valve plunger **115** to move to a downward position unsealing vent opening **113**, as shown in FIG. **8**. Thus, the decrease in air pressure within the pressure tube **78** and control valve manifold **112** triggers the actuation of control valve **81** to its open configuration. The actuation of the control valve to its open, downward position causes a release of pressurized air from within release valve manifold **105** through the control valve side opening **113** and then through vent opening **113** to ambience. This decrease in pressure causes release valve plunger **106** to move to a rearward position unsealing opening **98**, as shown in phantom lines in FIG. **9**. The position of the plunger **106** also causes and the O-ring to abut manifold **105** to seal the path between the manifold **105** and plunger **106**. With the unsealing of opening **98** pressurized air within pressure chamber **79** rapidly flows through opening **98**, through sealing plate bore **101**, through magazine mounting plate opening **91**, and into launch tube **90** in register with the sealing plate **100** where it propels the projectile P from barrel **89**. Operation of this type of release valve is described in more detail in U.S. Pat. No. 4,159,705.

Upon the release of pressurized air from pressure chamber **79** the pressurized air within indexer pressure cylinder **119** is conveyed through pressure tube **120** back into pressure chamber **79**. This release of pressurized air from indexer pressure cylinder **119** causes the indexer piston **121** to be spring biased by coil spring **123** back downward to its low pressure position. The downward movement of piston **121** pivotally retracts the indexing finger **125** from mounting plate groove **95** and positions the finger in register with the following mounting plate groove.

The pump plunger **129** may then be manually drawn back to its initial position to pressurize and fire the gun again. The drawing back of the pump plunger **129** does not create a vacuum within pump cylinder **128** since replenishment air may be drawn through vent **136** into the plunger handle **132**, through the interior of shaft **130**, and through check valve **135** into cylinder **128**. Air between the pump cylinder **128** and the plunger **129** behind seal **134** is expelled from cylinder **128** through vent **141**.

It should be noted that pawl **94** engages notches **93** to prevent rotation of the magazine **75** in a direction opposite to its indexing direction, i.e. to prevent clockwise rotation of the magazine with reference to FIGS. **7** and **8**. This prevents the firing of pressurized air into a previously emptied barrel and damage to the indexing finger **125**.

As an alternative, gun **70** may also be constructed without control valve **81**. The need for the control valve is dependent upon the length and interior diameter of pressure tube **78**, i.e. the volume of air contained within the pressure tube. For a pressure tube **78** having a small interior volume the release of air therefrom causes rapid actuation of release valve **80**. Conversely, with a pressure tube **78** containing a large volume of air therein the release of air therefrom may be inadequate to actuate the release valve properly. Thus, with pressure tubes having a large volume therein a control valve **81** is coupled to the release valve **80** to ensure rapid decompression within release valve manifold **105** to actuate the release valve. The gun may also be constructed without the inner launch tube **90** within the barrel **89**. Here, the pressurized air expelled from pressure chamber **79** is directed into barrel **89** behind the projectile. This design however is not preferred as it does not concentrate the burst of pressurized air for optimal efficiency and performance. Lastly, it should be understood that the magazine and indexer of FIGS. **6–9** may also be adapted to a hand held gun of conventional design.

It should be understood that the gun of FIGS. **6–9** may also be adapted to include the two concentric circle arrangement of the opening, as shown in FIGS. **1–5**, to increase the dart capacity of the magazine.

With the air gun of this construction a child may aim the gun simply by facing the intended target and manually actuating the hand pump. Because of the elongated, flexible pressure tube **78** the pump may be manipulated substantially independently of and without effecting the air of the launch tube. Thus, the gun is of an unconventional design to interest children yet is capable of being easily aimed and fired. Also, the child may fire several shots sequentially without having to reload between each successive shot.

With reference next to FIGS. **10** and **11**, a compressed air gun **159** in another preferred form is shown. Here, the air gun **159** is similar in basic construction to that shown in FIGS. **1–5**, except for the internal components for the sequential firing of pressurized air bursts and pneumatic indexing of the magazine, and the magazine grooves **160** are angled rather than being L-shaped. For this reason, only the new, alternative components of the air gun are shown for clarity and conciseness of explanation.

The air gun **159** has a pneumatic firing actuator **161** coupled to the pressure tank through pressure tube **56**. Actuator **161** includes an elongated manifold **162** having an inlet opening **163** in fluid communication with pressure tube **56**, an outlet opening **164** in fluid communication with a small pressure tank or pressure cell **165**, and an open end or firing opening **166** in fluid communication with an elongated recess **167**. A piston **168** is mounted for reciprocal movement within actuator manifold **162**. Piston **168** has a forward seal **169**, a rearward seal **170** and a clear button **171** extending through the air gun housing. The actuator **161** also has a flexible gasket **172** mounted within recess **167** in sealable contact with magazine **18**, and a pressure cylinder **173** in fluid communication with pressure cell **165** by a conduit **174**. A piston **175**, having an elongated piston rod **176**, is mounted within the actuator pressure cylinder **173** for reciprocal movement therein between a low pressure, pressurizing position shown in FIG. **10** and a high pressure, firing position shown in FIG. **11**. A coil spring **177** mounted about piston rod **176** biases the piston **175** towards its low pressure position. Piston rod **176** is coupled to piston **168** by an over center torsion spring **179**. An indexing finger **180**, mounted to an end of the piston rod **176**, is configured to sequentially engage and ride within each magazine groove **160** for sequential rotation of the magazine.

In use, an operator actuates the pump to pressurize a supply of air by grasping the handle **22** and reciprocating the cylinder rod **21** back and forth within the cylinder **20**. With piston **168** in its rearward pressurized air is passed through pressure tube **16** into the pressure tank **15**. Manual actuation of the trigger **13** moves thetrigger to a position wherein it unpinches pressure tube **56** so as to allow pressurized air within the pressure tank **15** to pass through pressure tube **56** into actuator manifold **162** through inlet opening **163** and between the forward and rearward seals **169** and **170** of piston **168**. The pressurized air then passes out of manifold **162** through outlet opening **164** and into pressure cell **165**, conduit **174**, and pressure cylinder **173**. The pressurized air within the pressure cylinder **173** causes piston **175** to move toward its high pressure position against the biasing force of coil spring **177**, i.e. the piston **175** is moved from its low pressure position shown in FIG. **10** to its high pressure position shown in FIG. **11**.

As shown in FIG. **11**, forward movement of the piston **175** causes compression and rotation of torsion spring **179** and the indexing finger **180** to move forward into a magazine groove **160**, thereby causing rotation of the magazine **18** and alignment of the opening to change to the inner circle of openings **28**". All references herein to forward and rearward is for purposes of clarity in reference to the drawings. Upon reaching the apex of the movement of piston rod **176** the torsion spring **179** reaches a rotated position which causes decompression of the spring thereby forcing piston **168** rearward, as shown in FIG. **11**. Rearward movement of piston **168** causes the forward seal **169** to be moved to a positioned between inlet opening **163** and the outlet opening **164**. This positioning of the piston **168** isolates manifold inlet opening **163** to prevent escape of pressurized air from pressure tank **15**, i.e. the seals sandwich the inlet opening to prevent the flow of air from the pressure tank. This positioning of the forward seal **169** also allows pressurized air within the pressure cell **165**, conduit **174** and pressure cylinder **173** to flow through outlet opening **164** into the manifold and from the manifold through firing opening **166**, through sealed recess **167** and into the launch tube **27** through magazine opening **28'**. Pressurized air within launch tube **27** propels the projectile out of the magazine barrel **26** and through gun barrel **12**.

The release of pressurized air from pressure cylinder **173** causes the piston **175** to be spring biased by coil spring **177** back rearward to its low pressure position. The rearward movement of piston **175** retracts the indexing finger **180** from within a mounting plate groove **160** and positions the finger in register with the following mounting plate groove **160**. The low pressure positioning of piston **175** causes the torsion spring **179** to bias piston **168** forwards to its initial position with the forward and rearward seals **169** and **170** sandwiching or straddling inlet and outlet openings **163** and **164**, as shown in FIG. **10**. This repositioning of piston **168** once again causes pressurized air within pressure tank **15** to flow through pressure tube **56** into actuator manifold **162**, thereby completing a firing cycle. The firing and indexing cycle just describe may continue in rapid sequence so long as the trigger is maintained in a position allowing the flow of pressurized air through pressure tube **56** and the pressure tank continues to contains a minimal level of pressurized air sufficient to overcome the biasing force of springs **177** and **179**, i.e. the release valve is automatically actuated by actuator **161** and the indexing of magazine **18** continues so long as the trigger is pulled open and the pressure tank contains pressurized air above a level to overcome springs **177** and **179**. Should the pressure level within pressure tank **15** reach the minimal level the operator simply actuates the manual air pump **14** so as to once again elevate the pressure within the pressure tank.

As described, the gun may be used in a fully automatic manner such that with the trigger maintained in a pulled back, actuated position the gun fires a series of projectiles without stopping between each successive shot, similar to the action of a machine gun. However, should an operator wish to fire a single projectile, one need only to pull the trigger and quickly release it so that pressurized air does not continue to flow into the actuator **161**. Operated in such a manner the gun will index the magazine and fire a projectile with each actuation of the trigger, again, so long as the pressure tank contains air pressurized above the minimal level and the trigger is quickly released.

It should be understood that at times rubber seals often stick when stored for a period of time. This sticking may hamper the performance of the actuator. For this reason, the actuator is provided with clear button **171** which may be manually actuated to cause reciprocal movement of the piston in order to unstick the seals.

With reference next to FIGS. **12–15**, there is shown a compressed air gun in another preferred embodiment, with like numbers referring to previously described components. Here, the air gun has a combination control valve and indexer **200** which controls the flow of compressed air from the pressure tank **15** to the magazine launch tubes **201** and indexes the magazine **202** with each firing, hereinafter referred collectively as control valve **200**.

The control valve **200** has an elongated, cylindrical, external tube or manifold **204**, a cylindrical, internal tube **205** mounted within the external tube **204**, and a plunger **206** mounted within the internal tube. The external tube **204** has an elongated slot **208**, an air inlet **209** in fluid communication with pressure tube **56**, and an air outlet **210** in fluid communication with magazine launch tubes **201**. The internal tube **205** is configured to move reciprocally within the external tube between a forward position shown in FIG. **13** and a rearward position shown in FIGS. **14–16**. The internal tube **205** and external tube **204** define a first air pressure chamber **212** therebetween, while the internal tube **205** and plunger **206** define a second air pressure chamber **213** therebetween. The internal tube **205** has an air release valve **215**, an O-ring seal **216** for sealing engagement of the internal tube with the external tube, and an L-shaped member **218** extending through slot **208**. L-shaped member **218** has an end flange **219**.

Plunger **206** is mounted within the internal tube **205** for reciprocal movement between a first sealing position abutably sealing air outlet **210** as shown in FIG. **13**, a second sealing position extending from the internal tube yet still sealing air outlet **210** as shown in FIGS. **14** and **15**, and an unsealing position distal from and unsealing air outlet **210** as shown in FIG. **16**. The air release valve **215** has an opening **221**, a plunger **222** mounted within opening **221**, an elongated rod **223**, and a coil spring **224** mounted about elongated rod **223**. The air gun also has a spring biased trigger **227** configured to releasably engage the internal tube L-shaped member **218**.

A coil spring **229** is mounted within internal tube **205** so as to abut plunger **206** and bias the plunger in a direction towards the air outlet **210**. Another coil spring **230** is mounted between the external tube **204** and the internal tube **205** so as to bias the internal tube in a direction towards the air outlet **210**.

The magazine **202** has an annular array of Z-shaped grooves **232** sized and shaped to receive the end flange **219** of the L-shaped member **218**. Each groove **232** has a forward camming surface **233** extending to a forward portion **234** and a rearward camming surface **235** extending to a rearward portion **236**.

In use and with the trigger **227** spring biased to its position engaging the internal tube L-shaped member **218**, the internal tube **205** is initial spring biased to its forward position by compressing spring **230**, as shown in FIG.**13**. This position of the internal tube forces spring **229** to bias plunger **206** to its sealing position. With the internal tube **205** in its forward position, the L-shaped member flange **219** resides within the Z-shaped groove forward portion **234**, as shown in FIG. **21**. It should be understood that the magazine of FIGS. **21** and **22** is illustrated with only one launch tube for clarity of explanation.

As compressed air flows from the pressure tube **56**, extending from the pressure tank **15**, and into the control valve **200** through air inlet **209**, the pressure within the first air pressure chamber **212** increases. Compressed air also passes from the first air pressure chamber, between the plunger **206** and the internal tube, into the second air pressure chamber **213**. The air pressure within the first and second air pressure chambers aid in maintaining the plunger **206** in its sealing position, as the pressure upon the backside of the plunger is greater than ambient air pressure upon the front side of the plunger.

As shown in FIG. **14**, with movement of the trigger **227** to its release position disengaged from the L-shaped member, the compressed air within the first air pressure chamber **212** causes the internal tube **205** to move to its rearward position. This movement of the internal tube compresses spring **230**. As the internal tube moves rearward the L-shaped member flange **219'** contacts the rearward camming surface **235**, as shown in phantom lines in FIG. **22**. With continued rearward movement of the internal tube, flange **219"** continues into the rearward portion **236** of the Z-shaped groove, as shown in FIG. **22**. The force of the flange upon the rearward camming surface causes the magazine to rotate clockwise approximately half the distance of a complete indexing cycle.

As the internal tube approaches the end of its rearward stroke the release valve spring **224** compresses to a point wherein the force of the spring overcomes the force of the air pressure within the second air pressure chamber **213**. This spring force causes the valve plunger **206** to move forward thereby unseating and allowing the compressed air within the second air pressure chamber **213** to escape rapidly therefrom through opening **221**, as shown in FIG. **15**. This rapid decompression of the second air pressure chamber **213** causes plunger **206** to snap back to its unsealing position, as shown in FIG. **16**. With the plunger in its unsealing position, the compressed air within the first pressure chamber **212** quickly passes through the air outlet **210** and into the launch tube **201**.

The release of the compressed air within the first air pressure chamber **212** causes the internal tube to move forward, through the spring biasing force of coil spring **230**. The forward movement of the internal tube causes the L-shaped member flange **219'''** to contact the forward camming surface **233**, as shown in phantom lines in FIG. **22**, and thus force the remaining indexing rotation of the magazine as the flange **219** once again resides within the forward portion **234**, as shown initially in FIG. **21**.

It should be understood that so long as the trigger is actuated to its disengaged position and so long as there is sufficient air pressure flowing from the pressure tube, the control valve will continue to fire projectiles, as the internal tube and plunger will continue to reciprocate as long as a sufficient amount of compressed air is present to overcome the forces of the springs. Alternatively, the trigger may be pulled and immediately released so that it reengages the L-shaped member after firing a single projectile.

With reference next to FIGS. **17–20**, there is shown the internal components and a portion of the magazine of a compressed air gun in another preferred embodiment, similar to that previously described in reference to FIGS. **12–16**. Here again, the air gun has a combination control valve and indexer **300** which controls the flow of air from the pressure tank **15** to the magazine launch tubes **201** and indexes the magazine **202** with each firing, hereinafter referred collectively as control valve. The control valve **300** has an elongated, cylindrical, external tube or manifold **304**, an internal tube **305** mounted within the external tube **304**, and a plunger **306** mounted within the internal tube. The external tube **304** has an elongated slot **308**, an air inlet **309** in fluid communication with pressure tube **56**, and an air outlet **310** in fluid communication with magazine launch tubes **201**. The internal tube **305** is configured to move reciprocally within the external tube between a forward position, shown in FIG. **17** and a rearward position, shown in FIGS. **18–20**. The internal tube **305** and external tube **304** define an air pressure chamber **312** therebetween. The internal tube **305** has an O-ring seal **316** for sealing engagement of the internal tube with the external tube, and an L-shaped member **318** extending through slot **308**. L-shaped member **318** has an end flange **219**. A coil spring **329** is mounted about the plunger **306** for biased movement of the plunger in a rearward direction.

Plunger **306** is mounted within the internal tube for reciprocal movement between a first sealing position abutably sealing air outlet **310** as shown in FIG. **17**, a second sealing position extending from the internal tube yet still sealing air outlet as shown in FIGS. **18** and **19**, and an unsealing position distal from and unsealing air outlet as shown in FIG. **20**. The air gun also has a spring biased trigger **327** configured to releasably engage the internal tube L-shaped member **318**.

A coil spring **330** is mounted about plunger **306** between the forward end of the internal tube and a sealing head **331** of the plunger. Coil spring **330** biases the plunger in a direction towards the air outlet. Another coil spring **328** is mounted between the external tube **304** and the internal tube so as to bias the internal tube in a direction towards the air outlet.

The magazine **202** has an annular array of Z-shaped grooves **232** sized and shaped to receive the end flange **219** of the L-shaped member **318**. Each groove **232** has a forward camming surface **233** extending to a forward portion **234** and a rearward camming surface **235** extending to a rearward portion **236**.

In use and with the trigger **327** is spring biased to its position engaging the internal tube L-shaped member, the internal tube **305** is initial spring biased to its forward position compressing spring **330**. This position of the internal tube forces spring **330** to bias plunger **306** to its sealing position. With the internal tube **305** in its forward position, the L-shaped member flange **219** resides within the Z-shaped groove forward portion **234**, as shown in FIG. **21**.

As compressed air flows from pressure tube **56** and into the control valve **300** through air inlet **309**, the pressure within air pressure chamber **312** increases. This air pressure aids in maintaining the plunger in its sealing position, as the pressure upon the backside of the plunger is greater than ambient air pressure upon the front side of the plunger.

As shown in FIG. **18**, with movement of the trigger to its release position disengaging the L-shaped member, the compressed air within the air pressure chamber **312** causes the internal tube **305** to move to its rearward position. This movement of the internal tube compresses springs **328** and **329**. As the internal tube moves rearward the L-shaped member flange **219'** contacts the rearward camming surface **235** so as to cause the magazine to rotate clockwise approximately half the distance of a complete indexing cycle, as shown in phantom lines in FIG. **22**. The flange **219"** continues into the rearward portion **236** of the Z-shaped groove.

As the internal tube moves to the end of its rearward stroke the plunger spring **329** compresses to a point wherein the force of spring **329** overcomes the force of the compressed air within the air pressure chamber **312** and upon the plunger sealing head **331**. This spring force causes the plunger **306** to move rearwardly to its unsealing position, thereby allowing the compressed air within the air pressure chamber to escape through the air outlet **310**, as shown in FIG. **19**. The release of the air pressure force upon the plunger allows spring **329** to force plunger **306** quickly rearward to maximize the rapid decompression of the air pressure chamber **312**, as shown in FIG. **19**.

The release of the compressed air within the air pressure chamber **312** causes the internal tube to move forward, through the spring biasing force of coil spring **328**. The forward movement of the internal tube causes the L-shaped member flange **219'''** to contact the forward camming surface **233**, as shown in phantom lines in FIG. **22**, and thus force the remaining indexing rotation of the magazine as the flange once again resides within the forward portion **234**, as shown initially in FIG. **21**. Again, the internal tube and plunger may continue to reciprocate as long as the trigger is disengaged and there is sufficient air pressure.

It should be understood that the second air pressure chamber **213** of FIGS. **13–16** performs the same function as spring **329** in FIGS. **17–20**, as they both function to snap the plunger rearward upon initial firing.

The gun shown in FIGS. **17–29** may also be adapted to include an internal flange **340**, shown in phantom lines, extending from the external tube **305**. Flange **340** has a opening **341** therethrough through which plunger **306** extends. Spring **330** abuts flange **340** so that the spring is slightly compressed to force plunger **306** towards its sealing position. As the internal tube **305** moves rearward the spring **330** is compressed further. As air is released from the first air chamber **312**, as previously described, spring **330** decompresses so as to force plunger **306** to is sealing position.

It should also be understood that compressed air may be directed into the control valve without the use of a pressure tank **15**, as shown in reference to FIGS. **6–9**. As such, the control valve may be coupled directly to a pump. Also, the triggering of the control valve, and thus the toy gun, may be accomplished through a valve or regulator mounted between the pressurized air source and the control valve, as shown in the previous embodiments.

While this invention has been described in detail with particular reference to the preferred embodiments thereof, it should be understood that many modifications, additions and deletions, in addition to those expressly recited, may be made thereto without departure from the spirit and scope of invention as set forth in the following claims.

We claim:

1. A compressed air toy gun comprising:

pump means for compressing air;

launch tube means for holding a projectile;

conduit means for conveying compressed air from said pump means to said launch tube means; and

control valve means for controlling the flow of compressed air from said pump means to said launch tube means, said control valve means comprising an external housing having an air inlet in fluid communication with said conduit means and an air outlet in fluid communication with said launch tube means, an internal housing mounted for reciprocal movement within said external housing between a first position and a second position, internal housing biasing means for biasing said internal housing towards said first position, a plunger mounted within said internal housing for reciprocal movement between a sealing position sealing said air outlet and an unsealing position unsealing said air outlet, plunger biasing means for biasing said plunger toward said sealing position, actuation means for actuating the movement of said plunger to said unsealing position, said external housing and said internal housing at least partially defining an air pressure chamber in fluid communication with said air inlet,

whereby compressed air from the pump means is conveyed through the conduit means and through the air inlet into the air pressure chamber, and the compressed air within the air pressure chamber biases the internal housing to its second position whereupon the actuation means causes the movement of the plunger is moved to its unsealing position allowing the compressed air within the air pressure chamber to flow through the air outlet to the launch tube.

2. The compressed air toy gun of claim **1** further comprising a pressure tank in fluid communication with said conduit means.

3. The compressed air toy gun of claim **1** wherein said internal housing biasing means comprises a spring.

4. The compressed air toy gun of claim **1** wherein said plunger biasing means comprises a supply of compressed air within said air pressure chamber.

5. The compressed air toy gun of claim **1** wherein said plunger and said internal housing define a second air chamber therebetween, and wherein plunger biasing means comprises a supply of compressed air contained within said second air chamber.

6. The compressed air toy gun **5** wherein said actuation means comprises an air release valve which releases compressed air from said second air chamber.

7. The compressed air toy gun of claim **6** wherein said internal housing biasing means comprises a spring.

8. The compressed air toy gun of claim **1** wherein said actuation means comprises engagement means coupled to said internal housing adapted to engage said plunger as said internal housing is biases to said second position.

9. The compressed air toy gun of claim **4** wherein said actuation means comprises engagement means extending from said internal housing adapted to engage said plunger as said internal housing is biases to said second position.

10. The compressed air toy gun of claim **9** wherein said internal housing biasing means comprises a spring.

11. The compressed air toy gun of claim **1** further comprising triggering means for releasably triggering the movement of said internal housing to said second position.

12. A compressed air toy gun comprising:

pump means for compressing air;

launch tube means for holding a projectile;

conduit means for conveying compressed air from said pump means to said launch tube means; and

control valve means for controlling the flow of compressed air from said pump means to said launch tube means, said control valve means comprising an external tube having an air inlet in fluid communication with said conduit means and an air outlet in fluid communication with said launch tube, an internal tube mounted within said external tube for reciprocal movement between a first position adjacent said air outlet and a second position distal said air outlet, a plunger mounted within said internal tube for reciprocal movement between a sealing position sealing said air outlet and an unsealing position unsealing said air outlet, spring biasing means for biasing said internal tube towards said first position, said external tube and said internal tube defining a first pressure chamber for releasably storing compressed air, said internal tube and said plunger defining a second pressure chamber for releasably storing compressed air, an air release valve in fluid communication with said second pressure chamber to controllably releasing the compressed air within said second pressure chamber,

whereby compressed air from the pump means is conveyed through the conduit means into the first pressure chamber and between the internal tube and the plunger to the second pressure chamber, the compressed air within the first pressure chamber biases the internal tube to its second position while the compressed air within the second pressure chamber maintains the plunger in its sealing position, and the actuation of the air release valve causes the compressed air within the second pressure chamber to be released thereby causing the plunger to move to its unsealing position thereby allowing the compressed air within the first pressure chamber to flow through the air outlet and into the launch tubes.

13. The compressed air toy gun of claim **12** further comprising a pressure tank in fluid communication with said conduit means.

14. The compressed air toy gun of claim **12** further comprising spring means for biasing said plunger towards said sealing position.

15. The compressed air toy gun of claim **12** further comprising triggering means for releasably triggering the movement of said internal tube to said second position.

16. The compressed air toy gun of claim **12** wherein said air release valve is actuated to release the compressed air within said second air pressure chamber upon said internal tube reaching said second position.

17. A compressed air toy gun comprising:

pump means for compressing air;

launch tube means for holding a projectile;

conduit means for conveying compressed air from said pump means to said launch tube means; and

control valve means for controlling the flow of compressed air from said pump means to said launch tube means, said control valve means comprising an external tube having an air inlet in fluid communication with said conduit means and an air outlet in fluid communication with said launch tube, an internal tube mounted within said external tube for reciprocal movement between a first position adjacent said air outlet and a second position distal said air outlet, a plunger mounted within said internal tube for reciprocal movement between a sealing position sealing said air outlet and an unsealing position unsealing said air outlet, spring biasing means for biasing said internal tube towards said first position, said external tube and said internal tube defining a pressure chamber for releasably storing compressed air, said internal tube having a portion sized and shaped to engage said plunger,

whereby compressed air from the pump means is conveyed through the conduit means into the pressure chamber, the compressed air within the pressure chamber biases the plunger to its sealing position while biasably moving the internal tube to its second position, the movement of the internal tube to its second position causes the plunger to move to its unsealing position thereby allowing the compressed air within the pressure chamber to flow through the air outlet and into the launch tubes.

18. The compressed air toy gun of claim **17** further comprising a pressure tank in fluid communication with said conduit means.

19. The compressed air toy gun of claim **17** further comprising a spring biasing means for biasing said plunger to said sealing position.

20. The compressed air toy gun of claim **17** further comprising triggering means for releasably triggering the movement of said internal tube to said second position.

21. A compressed air toy gun comprising:

pump means for compressing air;

launch tube means for holding a projectile;

conduit means for conveying compressed air from said pump means to said launch tube means; and

control valve means for controlling the flow of compressed air from said pump means to said launch tube means, said control valve means comprising an external tube having an air inlet in fluid communication with said conduit means and an air outlet in fluid communication with said launch tube means, a plunger mounted within said external tube for reciprocal movement between a sealing position sealing said air outlet and an unsealing position unsealing said air outlet, and pressure sensitive actuation means for controlled continuous, reciprocal actuation of said plunger so long as compressed air above a preselected pressure level flows from said conduit means to said control valve means,

whereby compressed air from the pump means is conveyed through the conduit means and through the air inlet to the control valve which continuously reciprocates the plunger for firing a sequence of projectiles.

22. The compressed air toy gun of claim **21** wherein said pressure sensitive actuation means comprises an internal tube mounted for reciprocal movement between a first position and a second position, internal tube biasing means for biasing said internal tube towards said first position.

23. The compressed air toy gun of claim **22** wherein said pressure sensitive actuation means further comprises plunger biasing means for biasing said plunger toward said sealing position, and wherein said external tube and said internal tube at least partially defining an air pressure chamber in fluid communication with said air inlet, whereby compressed air within the pressure chamber moves the internal tube to its second position.

24. The compressed air toy gun of claim **21** further comprising a pressure tank in fluid communication with said conduit means.

25. The compressed air toy gun of claim **21** wherein said internal tube biasing means comprises a spring.

26. The compressed air toy gun of claim **23** wherein said plunger biasing means comprises a supply of compressed air within said air pressure chamber.

27. The compressed air toy gun of claim **23** wherein said plunger and said internal tube define a second air chamber therebetween, and wherein plunger biasing means comprises a supply of compressed air contained within said second air chamber.

28. The compressed air toy gun **27** wherein said pressure sensitive actuation means further comprises an air release valve which releases compressed air from said second air chamber.

29. The compressed air toy gun of claim **22** wherein said actuation means comprises engagement means extending from said internal tube adapted to engage said plunger as said internal tube is biases to said second position.

30. The compressed air toy gun of claim **22** wherein said internal tube biasing means comprises a spring.

31. The compressed air toy gun of claim **21** further comprising triggering means for releasably triggering the movement of said pressure sensitive actuation means.

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